RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

	COST ($ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	33,579	38,723	41,964	40,254	41,845	37,527	34,546	Continuing	TBD
632480	Aerospace Fuels and Atmospheric Propulsion	1,904	2,198	2,075	2,984	3,164	3,228	3,292	Continuing	TBD
633035	Aerospace Power Technology	3,167	3,520	2,423	2,632	4,224	4,309	4,394	Continuing	TBD
63681B	Advanced Turbine Engine Gas Generator	28,508	33,005	37,466	34,638	34,457	29,990	26,860	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

(U) A. Mission Description

This program develops and demonstrates affordable turbine engine high pressure core components, advanced airbreathing engine concepts, high heat sink and thermally stable fuels, and power technology for air, space, and weapon power applications. Anticipated technology advances include turbine engine improvements providing a 33% reduction in aircraft takeoff gross weight for tactical fighter aircraft and a 100% increase in aircraft range/loiter; ducted rocket improvements that increase missile average and terminal velocity by 50% and range by 100% for enhanced lethality; higher temperature fuels for propulsion and thermal management; and electric power system components projected to provide a two-to-five-fold improvement in aircraft reliability and maintainability, a 20% reduction in power system weight, and enhaced vulnerablity and survivability. Note: In FY 2000, Congress added $0.4 million for aircraft and weapons power.

(U) B. Budget Activity Justification

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

(U) C. Program Change Summary ($ in Thousands)

		FY 1999	FY 2000	FY 2001	Total Cost
(U)	Previous President's Budget (FY 2000 PBR)	36,867	38,778	39,061	
(U)	Appropriated Value	36,984	39,178		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-117	-2		

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(U) C. Program Change Summary ($ in Thousands) Continued

		FY 1999	FY 2000	FY 2001	Total Cost
	b. Small Business Innovative Research	-1,195			
	c. Omnibus or Other Above Threshold Reprogram		-212		
	d. Below Threshold Reprogram	-1,905			
	e. Rescissions	-188	-241		
	f. Other				
(U)	Adjustments to Budget Years Since FY 2000 PBR			2,903	
(U)	Current Budget Submit/FY 2001 PBR	33,579	38,723	41,964	TBD

(U) Significant Program Changes:
Increased funding in FY 2001 reflects increased emphasis on turbine engine propulsion.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT: 632480

COST ($ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
632480 Aerospace Fuels and Atmospheric Propulsion	1,904	2,198	2,075	2,984	3,164	3,228	3,292	Continuing	TBD

(U) A. Mission Description

Develops and demonstrates new thermally stable, high heat sink, controlled chemically reacting fuels and advanced fuel system components that minimize cost, reduce maintenance, and improve performance of aerospace systems. Emphasis is on demonstrating the effects/benefits of JP-8+225 and JP-900 on advanced high temperature fuel system designs and components on upgraded and advanced systems.

(U) FY 1999 ($ in Thousands)

(U) $1,304 Demonstrated thermally stable JP-8+100 high heat sink fuel that reduces fuel system maintenance on current aircraft and provides greater cooling capacity (performance) for upgraded and future aircraft and missiles.

(U) $203 Demonstrated effectiveness of thermally stable JP-8+100 for reduced maintenance in a variety of aircraft.

(U) $300 Demonstrated advanced fuel system designs and high temperature components that permit utilization of the increased cooling capacity of JP-8+100 and high heat sink fuels.

(U) $97 Developed and demonstrated critical high-speed propulsion components/structures for manned and unmanned applications which will provide technology at lower risk for future missile systems where time-to-target is critical and for next generation reconnaissance/strike vehicles and airbreathing boosters.

(U) $1,904 Total

(U) FY 2000 ($ in Thousands)

(U) $888 Demonstrate thermally stable JP-8+100 high heat sink fuel that reduces fuel system maintenance on current aircraft and provides greater cooling capacity (performance) for upgraded and future aircraft and missiles. Determine the effects/benefits of thermally stable JP-8+100 and JP-8+225 fuel for several current and advanced fighter configurations.

(U) $725 Demonstrate effectiveness of thermally stable JP-8+100 for reduced maintenance in a variety of aircraft. Fabricate a subscale fuel system simulator for testing thermally stable JP-8+225 and other high heat sink fuels that reduce fuel system maintenance for the current inventory and future propulsion configurations.

(U) $410 Demonstrate advanced fuel system designs and high temperature components that permit utilization of the increased cooling capacity of JP-8+100 and high heat sink fuels. Design and fabricate heat exchanger for indirect cooling concept for advanced, high temperature engine designs.

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 632480

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

(U)	$175	Demonstrate a direct fuel/air heat exchanger for cooled cooling air systems. Compare performance and benefits of the direct fuel/air heat exchanger to the indirect system.
(U)	$2,198	Total

(U) FY 2001 ($ in Thousands)

(U)	$855	Demonstrate thermally stable JP-8+100 high heat sink fuel that reduces fuel system maintenance on current aircraft and provides greater cooling capacity (performance) for upgraded and future aircraft and missiles. Demonstrate, in a subscale fuel system simulator, the effects/benefits of thermally stable JP-8+225 and other high heat sink fuels that reduce fuel system maintenance for advanced fighter configurations.
(U)	$810	Demonstrate effectiveness of thermally stable JP-8+100 for reduced maintenance in a variety of aircraft. Fabricate a subscale integrated fuel/air heat exchanger-combustor in a cooled cooling air configuration, using fuel/air heat exchanger technology designed and fabricated in FY 2000.
(U)	$410	Demonstrate low-cost fuel-additive approaches to control particulate emissions from gas turbine engines. Demonstrate concepts for improving ignition and combustion in advanced engines.
(U)	$2,075	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602203F, Aerospace Propulsion.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2000

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT: 633035

COST ($ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
633035 Aerospace Power Technology	3,167	3,520	2,423	2,632	4,224	4,309	4,394	Continuing	TBD

(U) A. Mission Description

Develops and demonstrates aircraft and ground power systems including engine starters, auxiliary power units, and electrical power generation and distribution systems to enhance system reliability, survivability, and vulnerability, reduce weight, and lower life cycle costs for (manned and unmanned) aircraft and spacecraft while enabling high power density sources for directed energy weaponry.

(U) FY 1999 ($ in Thousands)

(U) $431 Designed, fabricated, and tested an electrical distribution system which ensures fault tolerant architecture, improving aircraft reliability and survivability.

(U) $931 Developed an aircraft electrical power generation and distribution system for test validation and flight demonstration which will ensure fault tolerant architecture and will improve aircraft reliability and survivability.

(U) $1,805 Designed, fabricated, and tested a demonstrator aircraft on-board Integrated Power Unit (IPU) which is critical for aircraft engine starting, auxiliary power, and emergency power.

(U) $3,167 Total

(U) FY 2000 ($ in Thousands)

(U) $740 Design, fabricate, and test a demonstrator aircraft on-board IPU which is critical for aircraft engine starting, auxiliary power, and emergency power. The demonstrator will integrate the switched reluctance starter generator with magnetic bearings and the turbomachine to demonstrate IPU feasibility, weight savings, and reliablilty improvements over conventional Auxiliary Power Unit/Emergency Power Unit (APU/EPU) approaches.

(U) $90 Perform IPU aircraft integration analysis to determine mission available power for Directed Energy Weapon (DEW) applications.

(U) $2,690 Develop power generation, conditioning, and distribution; energy storage; and thermal management component and subsystem technologies for manned and unmanned aircraft systems. Develop IPU prognostics health management and power electronics for increased reliability, decreased maintenance, and 2X increase in power density which is enabling for advanced fighter aircraft and Uninhabited Combat Aerial Vehicles (UCAV).

(U) $3,520 Total

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 633035

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands)

(U)	$596	Design, fabricate, and test an electrical distribution system which ensures fault tolerant architecture, improving aircraft reliability and survivability. Complete test of the demonstrator aircraft on-board Integrated Power Unit (IPU). The demonstrator will integrate the switched reluctance starter generator with magnetic bearings and the turbomachine to demonstrate IPU feasibility, weight savings, and reliablilty improvements over conventional Auxiliary Power Unit/Emergency Power Unit (APU/EPU) approaches.
(U)	$100	Design, fabricate, and test for emergency power capabilities of an IPU.
(U)	$1,727	Develop power generation, conditioning, and distribution; energy storage; and thermal management component and subsystem technologies for manned and unmanned aircraft systems. Test IPU prognostics health management and power electronics for increased reliability, decreased maintenance, and 2X increase in power density which is enabling for advanced fighter aircraft and Uninhabited Combat Aerial Vehicles (UCAV).
(U)	$2,423	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602203F, Aerospace Propulsion.

(U) PE 0602201F, Aerospace Flight Dynamics.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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DATE: February 2000

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT: 63681B

COST ($ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
63681B	Advanced Turbine Engine Gas Generator	28,508	33,005	37,466	34,638	34,457	29,990	26,860	Continuing	TBD

(U) A. Mission Description

This project develops turbine engine gas generator technology to meet the requirements of current and future aircraft propulsion systems. The objective is to provide the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and maintainability aspects can be assessed in a real engine environment. The gas generator, or core, is the basic building block of the engine and it consists of a compressor, a combustor, and a high pressure turbine. Experimental core engine testing enhances early, low-risk transition of key engine technologies into engineering development where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, and ships. The Advanced Turbine Engine Gas Generator project supports the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three phase, totally integrated DoD, Defense Advanced Research Projects Agency (DARPA), National Aeronautics and Space Administration (NASA), and industry program focused on doubling turbine engine propulsion capabilities while reducing cost of ownership. The IHPTET program structure provides continuous technology transition for military turbine engine upgrades and derivatives and has the added benefit of enhancing the U.S. turbine engine industry's international competitiveness and demonstrates affordable turbine engine high pressure core components.

(U) FY 1999 ($ in Thousands)

(U)	$23,485	Designed, fabricated, and performance tested technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports.
(U)	$982	Designed, fabricated, and durability tested technology demonstration core engines to provide increased durability and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports.
(U)	$4,041	Designed, fabricated, and tested technology demonstration core engines to provide improved performance and fuel consumption for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, theater transports, and large uninhabited air vehicles.
(U)	$28,508	Total

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology	PROJECT 63681B

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands)

(U)	$26,940	Design, fabricate, and performance test technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Initiate advanced core engine testing for integrally bladed rotor repair, impingement film floatwall combustor, advanced thermal barrier coating, supercooled high pressure turbine castability, and mistunning technologies. Design advanced hardware for core engine testing of load decoupler fan frame; ceramic matrix composite combustor liner; ceramic bearing; and advanced turbine vane, blade, and disk aterials. All of these technology innovations are appicable to a significant part of the Air Force engine inventory along with future engines including JSF F-119 and F-120 designs.
(U)	$2,006	Design, fabricate, and durability test technology demonstration core engines to provide increased durability and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Fabricate hardware for core engine testing in support of the national high cycle fatigue program, compressor rotor ring damper, compressor rotor damping coating, and advanced non-intrusive stress measurement system.
(U)	$4,059	Design, fabricate, and test technology demonstration core engines to provide improved performance and fuel consumption for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, theater transports, and large uninhabited air vehicles. Conduct core engine testing of splittered compressor rotor, rich quench lean combustor, counter rotating turbines, ceramic turbine vanes, and hybrid ceramic bearings. Design hardware for core engine testing of forward swept splittered compressor rotor, high temperature rise combustor, counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.
(U)	$33,005	Total

(U) FY 2001 ($ in Thousands)

(U)	$28,707	Design, fabricate, and performance test technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Complete core engine testing for integrally bladed rotor repair, impingement film floatwall combustor, advanced thermal barrier coating, supercooled high pressure turbine castability, and mistunning technologies. Design and fabricate long lead hardware for core engine testing of load decoupler fan frame, ceramic matrix composite combustor liner, ceramic bearing, and advanced turbine vane, blade and disk materials. All of these technology innovations are appicable to a significant part of the Air Force engine inventory along with future engines including JSF F-119 and F-120 designs.
(U)	$2,073	Design, fabricate, and durability test technology demonstration core engines to provide increased durability and affordability for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports. Conduct core engine testing of national high cycle fatigue program, compressor rotor ring damper, compressor rotor damping coating, and advanced non-intrusive stress measurement system.

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BUDGET ACTIVITY: 03 - Advanced Technology Development	PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology	PROJECT: 63681B

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$4,440	Design, fabricate, and test technology demonstration core engines to provide improved performance and fuel consumption for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, theater transports, and large uninhabited air vehicles. Conduct core engine testing of splittered compressor rotor, rich quench lean combustor, counter rotating turbines, ceramic turbine vanes and hybrid ceramic bearings. Fabricate hardware for core engine testing of forward swept splittered compressor rotor, high temperature rise combustor, counter rotating vaneless turbine, ceramic matrix composite turbine blades and vanes, and magnetic bearings.
(U)	$2,246	Design, develop, and test structures and propulsion designs to demonstrate performance and durability of advanced hypersonic propulsion concepts in support of Defense Advanced Research Projects Agency (DARPA) missile demonstration. Complete fabrication and testing of flight type scramjet combustor and inlet.
(U)	$37,466	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602201F, Aerospace Flight Dynamics.
(U) PE 0602203F, Aerospace Propulsion.
(U) PE 0603202F, Aircraft Propulsion Subsystem Integration.
(U) PE 0602122N, Aircraft Technology.
(U) PE 0603210N, Aircraft Propulsion
(U) PE 0603003A, Aviation Advanced Technology.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.